

FlexMaster: a universal system

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FlexMaster[®] NiTi files have been in successful application for some years, not only in Germany but also worldwide, and their use is becoming increasingly widespread. The cutting blade design of K-type files provides for efficient working and effective removal of dentinal debris. Due to their convex cross-sectional profile, these instruments are moreover equipped with a more solid instrument core which reduces the risk of fractures and deformations. FlexMaster[®] instruments are among the most comprehensively investigated rotary NiTi instruments. Very good results have been reported both in numerous in vitro studies and in an in vivo setting. The present article elucidates and assesses both the scientific setting and the clinical aspects of the system.

Background

FlexMaster (FM) nickel–titanium (NiTi) files (VDW, Munich, Germany) have been used in Europe successfully for some time. The present article describes the scientific evidence supporting their uptake as well as various clinical aspects of the system.

Geometry and design of FM files

The cutting blades of FM instruments have no radial lands to provide efficient and effective removal of dentine. Because of their convex cross-sectional profile (Fig. 1), the instruments have a more substantial core that reduces the risk of instrument fracture and deformation. This geometry means that the alloy core is exposed to less stress during torsional loading than instruments with a more slender core. For example, Hübscher et al. (2003), reported that FM instruments generated low torque scores and were highly resistant to cyclic fatigue.

FM instruments have a non-cutting rounded guiding tip that has the potential to reduce the creation of zip and elbows. With all NiTi systems the risk of fracture declines with decreasing rotational speed, as the instrument is exposed to torsional and bending stresses with each revolution in curved canals. A low rotational speed of 280 r.p.m. is therefore recommended for FM. The files are available in ISO sizes 15–70. The taper of 2%, 4% and 6%, respectively, is marked with milled rings on the shank of the instrument. The available lengths

are 21, 25 and 31 mm (Table 1). For individual length marking, all instruments are supplied by the manufacturer with a rubber stop. Calibration on radiographs is assisted by additional depth markings at 18, 19, 20 and 22 mm on the instruments.

As with almost all rotary root canal preparation systems, the canal is prepared in the crowdown technique. Preparation commences with the IntroFile, which has a conicity of 11% and a 9 mm long, active working section. This permits rapid tapered preparation of the canal entrances as well as shaping of the coronal third of the canal. Preparation of the middle third of the canal is completed with one of three simple sequences for large canals (blue sequence), medium canals (red sequence) or narrow canals (yellow sequence). Apical preparation is performed on completion of the crowdown phase using files with increasing diameters (green sequence).

Instrument management can be simplified by using the System Box, on which the sequences are illustrated (Fig. 2). Additional holes are provided in the Box to hold other instruments that may be required.

The sequence, in which the files are used, can be varied according to the personal preference of the practitioner. The apex of wide canals can generally be approached without difficulty with instruments having a large taper. When using the instruments in an individually selected sequence, care must always be taken to ensure that the instruments are not subjected to excessive stress. It is therefore important to observe the generic guidelines used for all other NiTi systems.

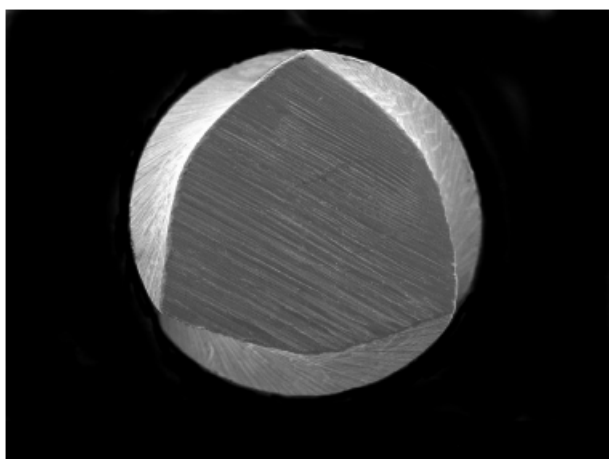


Fig. 1. Cross-sectional profile of a triangular FlexMaster file with convex external profile (courtesy of PD Dr Schwarze, Hanover, Germany).

Table 1. Available FlexMaster instruments in different lengths, conicities and ISO sizes

Taper (%)	Marking	ISO size	Length (mm)
2	One ring	15–70	21, 25, 31
4	Two rings	15–40	21, 25, 31
6	Three rings	15–40	21, 25

Torque-controlled rotary motion

Motors with torque control make a notable contribution to increased safety during rotary root canal preparation with NiTi instruments.

For FM instruments, the ‘Endo IT professionell’ low-torque-controlled motor with instrument-individualized torque is available (Fig. 3). This motor is highly versatile as it provides the optional settings for NiTi systems from other manufacturers. In addition to the established systems Profile, GT Rotary, Lightspeed and Hero, settings for more recent systems (ProTaper and K3) have been included in the programming options. An interface permits an update for new file systems or modified parameters within 30 s. The motor offers two operating levels:

Level I: for ‘NiTi novices’ (low-torque values).

Level II: for ‘experienced users’ (higher torque values).



Fig. 2. FlexMaster System box with sequences for root canals of different widths.



Fig. 3. ‘Endo IT professionell’ torque-controlled motor with angled handpiece.

This setting facility may partially offset typical errors created by beginners, e.g. inadequate application of lubricant, leaving the instrument too long in the root canal, etc. On the other hand, it gives the experienced practitioner the opportunity to reuse instruments at low-torque ratings to provide an added degree of safety. An acoustic signal when a file reaches 75% of the set



Fig. 4. These two maxillary molars were prepared with FlexMaster files and filled with gutta-percha points and sealer in the lateral condensation technique by second-year students.

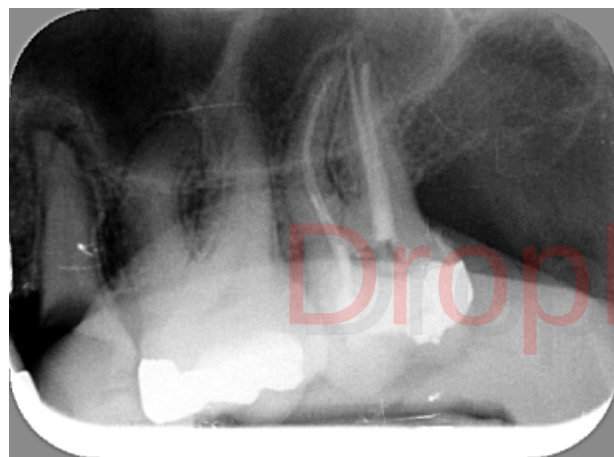


Fig. 5. Same as Fig. 4.

torque limit provides adequate warning before wedging in the canal occurs. As a result, the automatic reverse function with acoustic signal on reaching the programmed resistance value is only seldom required. Both features are helpful in avoiding fractures and enhance the safety of an instrument considerably.

In addition to the preprogrammed file sequences for large, medium and narrow canals, the motor offers individually programmable sequences with instruments from different manufacturers.

Recent findings with FM

FM instruments are among the most comprehensively investigated rotary NiTi instruments. Very good results

have been reported both in numerous *ex vivo* studies and in a clinical setting (Figs 4 and 5).

Use of FM files was reported to save 20–50% of the time invested in manual preparation. Correct preparation lengths were also achieved significantly more often than with manual preparation.

Several studies have confirmed the retention of the original shape of the root canal and have concluded that the risk of canal transportation when preparing curved root canals was greater than with Lightspeed instruments.

Contradictory findings are also reported in SEM studies on smear layer removal with FM instruments and flexible stainless-steel files. Whereas Chanteaux et al. (2001) reported better smear layer removal with FM instruments, flexible stainless-steel instruments proved more efficient for this purpose in a study by Schäfer & Lohmann (2002b).

FM instrument fractures occur only occasionally during preparation. A comparison with results of studies of other NiTi systems shows that the safety and reliability of FM instruments are good.

These and other findings have resulted in mechanical root canal preparation with the FM system becoming an integral part of the undergraduate curriculum at numerous German universities.

Conclusions

Curved root canals can be prepared without difficulty with FM NiTi instruments by both experienced practitioners and by novices. In particular the positive results of numerous studies with inexperienced operators demonstrate that this system is simple and user-friendly.

Further Reading

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